Building 776/777 2nd Floor Final Survey Report

Survey Unit: 776038

February 2005

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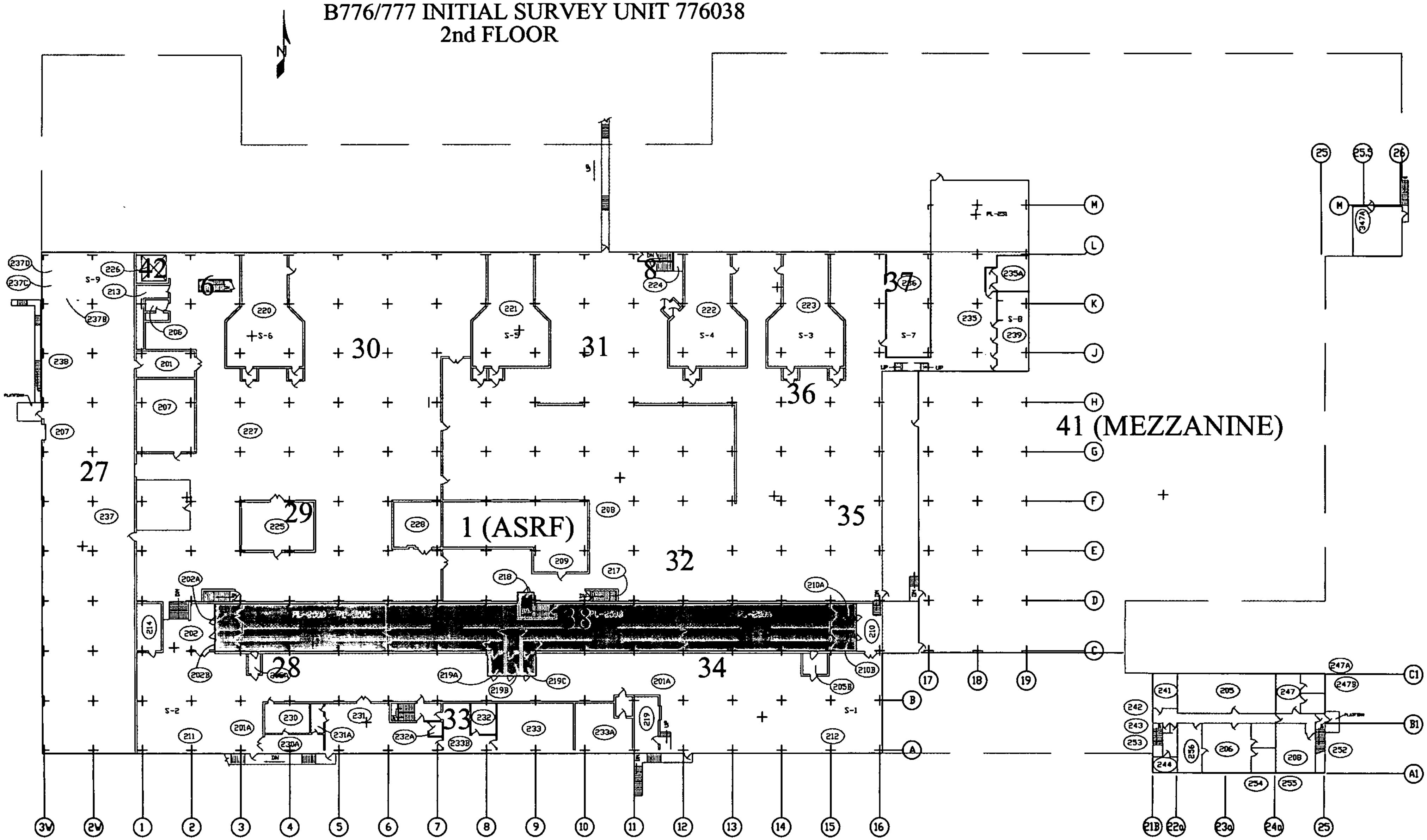
B776/777 INITIAL SURVEY UNIT 776038
2nd FLOOR



Survey Instructions
Building 776 2^{nd} Floor
Survey Unit 776038

Purpose:

This instruction provides guidance for collecting gross gamma and removable contamination data to quantify the amount of residual contamination in Survey Unit 776038 prior to demolition. NaI measurements are performed in accordance with " INS-535-Ludlum2350-1 with Sodium Iodide Detector".

Equipment and materials:

1. A Ludlum 44-17 attached to a Ludlum 2350-1 set to collect five-minute counts that will be displayed on its LCD window.
2. A Bicron G-5 attached to a Ludlum 2350-1 set to collect five-minute counts that will be displayed on its LCD window.
3. One Electra with attached DP-6, calibrated and daily response checked.
4. Two probe holders, one for the G-5 and one for the 44-17 with tin shielding.
5. Calibrated and daily response checked SAC-4.
6. Measuring tape or laser range finder.

Note: The NE Electra with DP-6 probe and the Eberline SAC-4 shall be used in accordance with RSP- 7.01 and 7.02

Procedure:

1. Inspect instrument for obvious damage and ensure battery voltage is equal to or greater than 4.6 volts. If battery voltage is less than 4.6 volts change the batteries.
2. Complete daily performance checks for Sodium Iodide detectors to ensure the instrument is functioning properly by using Americium-241 source TS-912. Record results on Sodium Iodide Data Sheet.
3. For floor and concrete wall background measurements, perform a 300-second background count with a Bicron G-5 for floors or Ludlum 44-17 for walls at background location in room 201-A near column B-13. Record background counts next to "Bkg Floor" or "Bkg Concrete Wall"in background column of attached "Sodium Iodide Data Collection" sheets as needed.
4. For block wall background measurements, perform a 300-second background count with a Ludlum 44-17 at the background location in room 219. Record background counts next to "Bkg Block Wall" in background column of attached Sodium Iodide data collection sheets as needed.
5. For ceiling and metal floor background measurements, perform a 300-second background count with a Ludlum 44-17 or Bicron G-5 at background location in room 201-A near column B-13. Hold the probe waist high, pointed toward ceiling using a sheet metal plate in front of the detector (take background measurement in this configuration). Record background counts next to "Bkg Metal Floor" for the G-5 and " Bkg Metal Ceiling" for the 44-17 on the attached Sodium Iodide data collection sheets as needed.
6. Mark the sample locations on the surfaces to be measured. Take all measurements on contact with the marked surface using tin side shields on the Bicron G-5 and tin side and back shields on the Ludlum 44-17. All Sodium Iodide readings shall have 300 second count times.
7. Collect sodium Iodide, total surface activity and removable surface activity measurements at all locations marked on the attached map.
8. Record the NaI and NE Electra measurements on the attached sheet. Note any items or conditions that may have affected the measurement in the "remarks" section.
9. Count swipes for 60 seconds with a SAC-4, record result on attached sheet for removable contamination.

Survey Instructions
Building 776 2nd Floor
Survey Unit 776038

Survey Requirements				
Surface	**Type of Survey**	**Probe**	**Placement**	**Count Time**
Floor	Total Alpha Activity	Bicron G-5	On contact	300 seconds
All Surfaces	Total Alpha Activity	Electra with DP-6	On contact	60 seconds
Block walls	Total Alpha Activity	Bicron G-5 or Ludlum 44-17	On contact	300 seconds
All Surfaces	Removable Alpha	SAC-4	Swipe in placed in tray	60 seconds
Ceiling	Total Alpha Activity	Ludlum 44-17	On Contact	300 seconds
Block Walls	Background measurement	Bicron G-5 or Ludlum 44-17	On contact with wall in room 219	300 seconds
Metal Floors	Background measurement	Bicron G-5 or Ludlum 44-17	Probe waist high, pointed toward ceiling with sheet metal plate on end in room 201-A near column B-13	300 seconds
Floors and cement walls	Background measurement	Bicron G-5 or Ludlum 44-17	On contact with floor in room 201-A near column B-13	300 seconds
Metal ceilings	Background measurement	Ludlum 44-17	Probe waist high, pointed toward ceiling with sheet metal plate on end in room 201 near column B-13	300 seconds

Attachment 1

Standard Method for Calculating the ASCV for Each Survey Unit

Prerequisites:

1. Final survey map for the survey unit
2. PDS survey results
3. Survey information used to estimate activities in inaccessible areas;
4. Survey information for any structural members or elevated regions not represented by the PDS survey.

Conversions:

1 square meter (m^2) = 100 x 100 cm^2

1 microcurie (μCi) = 2.22x 10^6 dpm

1 (μCi/ m^2) = 22,200 dpm/ 100cm^2 evenly distributed over one square meter.

12 inches = 1 foot = 0.305 meters

Calculations:

Accessible Area Inventory

1. Calculate the average surface contamination for the applicable survey unit from a minimum of 30 sodium iodide measurements obtained by the PDS survey.
2. Average the total surface contamination activity present.
3. Convert the average surface contamination value from step 2 from "dpm/ 100cm^2" to "μCi/ m^2"

   Example:

   22,200 dpm/100cm^2 x (100 x 100 cm^2/ m^2) x (1μCi/2.22x 10^6 dpm) = 1 μCi/ m^2

4. Obtain surface area of survey unit from title box of final survey map. This is reported in square meters.
5. Calculate inventory for accessible areas

   The surface area from a survey unit map title box is 1,000 square meters and the average contamination level from the 30 PDS points is 22,200 dpm/ 100cm^2.

   Example:

   1,000 m^2 x 22,200 dpm/ 100cm^2 x (100 x 100 cm^2/ m^2) x (1μCi/2.22x 10^6 dpm) = 1,000 μCi

Inaccessible Area Inventory

1. Document methods used to estimate contamination levels and potential inventory in seams, cracks or other surfaces in the final survey report. Provide an estimated remaining inventory for each item/area in the report.

   Example:

   There are 20 feet of seams contaminated to an average level of 2,220,000 dpm/100 cm^2. Each seam has two sides. The total inventory can be estimated assuming the contamination levels measured at the top of the seam extend down each side of the seam. The depth of the seam can be determined from design drawings or from direct observation as the seam is chipped away. If a seam is determined to be 4 inches deep, then the inventory of the seam can be calculated as follows:

   The contaminated area of the seam is:

   (20 feet x .305 m/ft) * (0.3 feet x 0.305 m/ft) = .61 m^2 x 2 sides = 1.22 m^2

   Therefore the inventory in the seam in μCi is:

   1.22 m^2 * (2,220,000 dpm/100 cm^2) * (10,000 cm^2/ m^{-2})* μCi /2.22E6 dpm = 122 μCi

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FINAL SURVEY REPORT
Survey Unit 776038

Introduction and Scope

A pre-demolition radiological survey (PDS) is performed prior to building demolition to define the radiological conditions of a facility. A PDS survey for survey unit 776038 has been completed in accordance with guidelines outlined in the "Radiological Pre-Demolition Survey Plan Building 776/777". Based on the results it is recommended that no further remediation is needed, and that the survey unit may be encapsulated in preparation for demolition. Isolation controls shall be put in place to prevent recontamination of the area. This report has been prepared in accordance with sections 3 and 8 of the "Radiological Pre-Demolition Survey Plan Building 776/777".

Survey unit 776038 includes Plenum 250 and all of its airlocks. It is on the second floor and is bounded by column lines 3 and 15 on the west and east sides and column lines C and D on the south and north sides.

PDS Methods and Techniques

The PDS survey results determine the Average Surface Contamination Value ($ASCV_u$) and source term for the survey unit. These parameters are used determine whether the building may be demolished within the limits outlined in the "Radiological Pre-Demolition Survey Plan Building 776/777".

To comply with the "Radiological Pre-Demolition Survey Plan Building 776/777", a minimum of 30 survey points were selected per survey unit. A random start, systematic grid method was used to identify the survey point locations. Three types of surveys are performed at each survey point as follows:

- Painted surfaces are evaluated for potential contamination under coatings using sodium iodide (NaI) gamma detectors attached to a single channel analyzer windowed for the 59 keV gamma-ray (Am^{241}).
- Direct alpha surface contamination measurements are performed using a NE Electra survey instrument with attached DP-6 probe. This data may be compared to the NaI survey data to show the fraction of contamination that is directly on the surface verses imbedded in the material matrix.
- Removable surface alpha contamination surveys were performed by swiping the survey point with a 47mm filter paper then counting the filter paper on a SAC-4 alpha counter. This data may be used to gauge the effectiveness of encapsulation following the PDS.

To conservatively determine the final Average Surface Contamination Value ($ASCV_u$) for the survey unit, the source term associated with inaccessible areas of the survey unit (as described below) is added to the source term calculated by the PDS survey.

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ALARA Post Remediation Surveys

Accessible Areas

In addition to the PDS used to determine the Average Surface Contamination Value ($ASCV_u$) and source term for the survey unit, surveys were taken to determine the effectiveness of remediation efforts. Remediation is performed to demonstrate a reasonable best effort is made to maintain releases to the environment and doses to the workers ALARA.

Remediation may include decontamination, or removal of parts of the structure such as block wall removal.

Floors

The floors of survey unit 776038 consisted of paint covered concrete. In-process measurements collected on the floor of 776038 show that all of the floor north of the first stage filter racks had elevated activity. The floor north of the first stage filter racks was remediated by shaving before being re-surveyed.

Average contamination levels on the floors before shaving was 3,947,340 dpm/100cm^2. Post remediation surveys found an average contamination level of 16,648 dpm/100cm^2

Remediation of the elevated floor areas resulted in a decontamination factor (DF) of 237, or a source term reduction of 99.6%

The base of the first stage of filter racks was also highly contaminated but could not be shaved. It was decontaminated using hand tools. The average contamination level along the length of this curb-like structure was the same as the rest of the floor before decontamination. After decontamination this structure had the same potential for contamination as the rest of the floor and its inventory is accounted for as part of the accessible area inventory.

The areas referred to as "speed bumps" in the In-Process report were decontaminated with hand tools. The majority of their surfaces were decontaminated to the same levels as the floor around them. The small crevices that were formed between the speed bumps and the north wall are accounted for in the estimate for activity for the curved surface interface between the floor and the north wall listed in inaccessible areas below.

Walls

Much of the walls were decontaminated by the removal of fixatives prior to the performance of the In-Process survey. The removal of the lower five feet of the North wall resulted in the greatest amount of decontamination. Walls 12 D, 12E and 12F were not accessible due to controls in place as a result of the asbestos abatement. Wall sections 10A through 10H will be painted orange and special controls will be applied during demolition.

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Survey Unit 776038

Table 1
B776/777 Survey Unit 776038 – Wall Summary

Wall	Section	Area (m^2)	Comments	Initial Characterization ($dpm/100cm^2$)			Follow-up Characterization ($dpm/100cm^2$)			Wall Section Inventory (uCi)
				Type I	Type II	Type III	Type I	Type II	Type III	
1	A	14		36,141			36,141			22.79
2	A	16		23,478			23,478			17.43
3	A	13		39,768			39,768			22.61
4	A	16		35,811			35,811			26.58
5	A	14		64,301			64,301			40.54
6	A	16		64,697			64,697			48.03
7	A	13		68,852			68,852			39.14
8	A	16		41,169			41,169			30.56
9	A	25			282,754			282,754		321.46
10	A	31				3,665,334		663,514		937.44
10	B	31				1,314,510		161,568		228.27
10	C	31				11,675,126		315,627		445.93
10	D	31			158,060			118,092		166.84
10	E	31			130,266		89,695			126.72
10	F	20			191,807			126,431		115.80
10	G	19			666,864			295,901		249.77
10	H	31			914,663			404,265		571.16
10	I	31			545,275			140,194		198.07
10	J	31		97,044			79,687			112.58
10	K	31			205,549		92,025			130.02
10	L	31			249,163		89,940			127.07
11	A	25		85,549			85,549			97.26
12	A	31		23,247			23,247			32.84
12	B	31		42,538			42,538			60.10
12	C	31		17,559			17,559			24.81
12	D	31	Inaccessible							0.00
12	E	31	Inaccessible							0.00
12	F	26	Inaccessible							0.00
12	G	31		29,678			29,678			41.93
12	H	31		46,742			46,742			66.04
12	I	31		15,723			15,723			22.21
12	J	31		22,753			22,753			32.15
12	K	31		35,366			35,366			49.97
12	L	31		33,635			33,635			47.52
13	A	13		44,926			44,926			26.20
14	A	16		42,978			42,978			31.90
15	A	14		54,079			54,079			34.10
16	A	16		36,822			36,822			27.33
17	A	13		51,991			51,991			29.55
18	A	16		79,030			79,030			58.67
19	A	14		46,825			46,825			29.52
20	A	16		40,889			40,889			30.35
21	A	4		35,448			35,448			6.23

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Survey Unit 776038

Wall	Section	Area (m^2)	Comments	Initial Characterization ($dpm/100cm^2$)			Follow-up Characterization ($dpm/100cm^2$)			Wall Section Inventory (uCi)
				Type I	Type II	Type III	Type I	Type II	Type III	
22	A	1		55,068			55,068			2.54
23	A	4		40,065			40,065			7.04
24	A	1		37,921			37,921			1.75
25	A	4		41,878			41,878			7.36
26	A	1		73,699			73,699			3.39
27	A	4		38,086			38,086			6.69
28	A	1		48,144			48,144			2.22
29	A	4		36,602			36,602			6.43
30	A	1		40,559			40,559			1.87
31	A	4		45,835			45,835			8.06
32	A	1		37,921			37,921			1.75
33	A	11			167,105		91,135			84.85
34	A	7			128,889			128,889		41.53
35	A	3			248,241			248,241		36.36
36	A	15	Blocked	by	decon		53,277			38.1
37	A	10	Blocked	by	decon		66,610			28.5
38	A	24	Blocked	by	decon			106,721		116.0
39	A	11	Blocked	by	decon			158,060		78.3
40	A	10			433,338			433,338		185.57
41	A	29						270,030		357.8
		Total Area		Avg. dpm/100 cm^2			Avg. dpm/100 cm^2			
		1,164		634,946			109,628			
	Type 1: <100,000 dpm/100 cm2									
	Type 2: >100,000 dpm/100 cm2 to <1,000,000 dpm/100 cm2									
	Type 3: >1,000,000 dpm/100 cm2									

Ceilings
Ceiling grids, 38-83 to 38-88, 38-91 to 38-93, 38-96 and 38-97 were found to have elevated levels of contamination on them. The contaminated panels could not be removed without affecting the engineered ventilation for the building. A series of contact readings taken on the elevated ceiling panels after all items that could be removed were removed. The average contamination level for these grids during the in-process survey was 1,475,612 dpm/100cm^2. The average of the follow-up readings is 327,644 dpm/100cm^2. The decontamination factor calculated from the average contamination levels is 4.5, which indicates a 78% reduction in contamination levels. These panels will be painted orange and special controls will be put in place during demolition.

Inaccessible Areas

Floors

Curved Surface along North Wall

The interface between the north wall and the floor was a curved surface that could not be shaved. It was also decontaminated with hand tools. The average contamination levels along

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this edge were 3,947,340 dpm/100cm^2 before decontamination. The current average contamination level is 703,887 dpm/100cm^2 (31.7µCi/m^2). The contamination in this area is higher than the rest of the floor because areas near the base of columns and points where contaminated seams met the wall could not be decontaminated completely. The decontamination factor for this area is 5.6 and the inventory reduction is 82%. The affected area is 0.5 feet (0.15m) high and 240 (73.2 m) feet long. The total residual contamination in this area is:

*(11.0m²) • (703,887 dpm/100 cm²) * (10,000 cm²/ m-²)* (µCi /2.22E6 dpm) = 348 µCi*

Expansion Joints

There were three expansion joints uncovered during shaving. All three were decontaminated using hand tools. Only one seam had residual contamination levels above background after decontamination. The northern most 3 feet (1m) of the expansion joint between columns D-3 and D-4 had an average contamination level of 403,000 dpm/100 cm^2. There is an average of 4 inches (0.1m) of concrete remaining between the bottom of the area excavated during decontamination and the bottom of the second floor slab. It is assumed that the contamination extends down both sides of the remainder of the joint. The estimate of contamination remaining in this joint is:

(2 • .1 m²) • (403,000 dpm/100 cm²) (10,000 cm²/ m-²)* (µCi /2.22E6 dpm) = 3.6 µCi*

Cracks

There was a contaminated crack at the base of the west wall of the plenum that extended for 2 feet (.61m)up and 8 inches into the wall. Contamination levels in this crack were up to 24,000,000 dpm/100 cm^2. Decontamination of this crack was halted because of the risk of undermining the 16 feet of wall above it. The contamination is assumed to extend the remaining 4 inches (0.1m) to the other side of the wall and cover both sides of the crack. The average of four readings taken in the decontaminated area is 935,515 dpm/100 cm^2. The estimated inventory of this crack is:

*(2 *.061 m²) * (935,515 dpm/100 cm²)* (10,000 cm²/ m²)*(µCi /2.22E6 dpm) = 5.1 µCi*

Area under the Base of the Demister Rack

There is a gap under the base of the demister rack, which could not be shaved. This area was decontaminated by scraping all loose epoxy and fixatives out from under it with hand tools. The maximum contamination levels detected prior to decontamination were up to 10,000,000 dpm/100 cm^2. The average of 20 readings performed along the entire length of the racks after decontamination is 625,637 dpm/100 cm^2. One small hotspot that is less that 0.05 m^2 is 19,766,675 dpm/100 cm^2. This hot spot is lodged between heavy metal fittings and could not be decontaminated. The demister rack base is 200 feet long and 6 inches wide, the total contaminated area is 100 square feet ($9.3m^2$). The total inventory under the base of the demister rack is:

Majority of area $=(9.3\ m^2) \cdot (625{,}637\ dpm/100\ cm^2) \cdot (10{,}000\ cm^2/m^{-2}) * (\mu Ci/2.22E6\ dpm) = 262.1\ \mu Ci$

$+$ *Hotspot* $= (0.05\ m^2) \cdot (19{,}766{,}675\ dpm/100\ cm^2) \cdot (10{,}000\ cm^2/m^{-2}) * (\mu Ci/2.22E6\ dpm) = 44.5\ \mu Ci$

Total = 262.1 + 44.5 = 306.6 μCi

Columns

The lower five feet of Columns D-3 to D-15 were exposed when the contaminated block was removed. Portions of these columns that were in contact with the contaminated block were found to be contaminated also. The seven most highly contaminated columns had residual concrete and cider block in them which was removed. Removing this residual material greatly reduced the contamination levels on these columns. Prior to clearing the concrete remnants, column D-10 had levels up to 150,000,000 dpm/100cm^2

The contamination levels remaining on the exposed portions of all of the columns range from 19,695 dpm/100cm^2 to 33,926,121 dpm/100cm^2. Decontamination efforts in these areas were not effective because the highest contamination levels were in crevices that were sealed over with fixatives as the block wall was removed. These areas are also very close to a contaminated piece of lathing that presents a significant puncture wound hazard. The average of 88 readings taken on the columns is 2,424,883 dpm/100cm^2 (109.23 $\mu Ci/m^2$). The contaminated portions of these columns average 10 square feet on each column. There is a total of 130 square feet (12 m^2) of area with elevated contamination levels. The total activity remaining on these columns:

$(12\ m^2) \cdot (2{,}424{,}883\ dpm/100\ cm^2) * (10{,}000\ cm^2/m^2) * (\mu Ci/2.22E6\ dpm) = 1310.76\ \mu Ci$

Walls

Contaminated Lathing

A strip of contaminated lathing extends along the north wall just above the portion of wall that was removed. The surface of the lathing facing into the plenum was surveyed and found to have the same potential for contamination as the surrounding wall. The surface exposed by the removal of block could not be surveyed completely due to the high potential for puncture wounds and damage to detectors. Surveys performed when a portion of this lathing accidentally fell off the wall indicate that the average contamination level for the contaminated side of the lathing is 500,000 dpm/100cm^2. Approximately 200 feet (61 m) of the lathing remains on the wall and the contaminated portion is approximately 1.0 foot (0.3m) wide. The total activity remaining on the lathing that was not accessible to the PDS survey is:

$18.3\ m^2 \cdot (500{,}000\ dpm/100\ cm^2) * (10{,}000\ cm^2/m^{-2}) * (\mu Ci/2.22E6\ dpm) = 412.2\ \mu Ci$

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Ledge along North Wall where Block was removed

There is a 1 foot (0.3m) wide ledge that extends for 240 feet (73.1m) along the lower portion of the north wall that could not be decontaminated by shaving. The ledge had elevated contamination levels on it up to 15,000,000 dpm/100cm^2 prior to decontamination. The highest contamination level found after decontamination was 3,900,000 dpm/100cm^2. The average of 59 measurements taken along this ledge is 690,811 dpm/100cm^2. The total activity remaining on the ledge that was not accessible to the PDS survey is:

$$21.9\ m^2 * (690{,}811\ dpm/100\ cm^2) * (10{,}000\ cm^2/m\text{-}^2) * (\mu Ci/2.22E6\ dpm) = 682.4\ \mu Ci$$

Seam In Northwest Corner of Plenum 250

The seam where the north wall meets the west wall was found to have elevated levels of contamination. Lower portion of this seam was aggressively decontaminated. Concrete and block were removed from the lower three feet until the column was exposed. The column itself was not found to be contaminated. It was discovered that the contamination in the seam extended to the top of the wall. The remainder of the seam was decontaminated by removing the paint and a thin layer of concrete. Initial contamination levels in the area were as high as 30,000,000 dpm/100cm^2. The average of 10 readings taken along the length of the contaminated seam is 811,520 dpm/100cm^2. The aggressive decontamination revealed that the contamination decreased to background levels at 4 inches deep (0.1m). The column is 18 feet (5.5) tall. The contamination is assumed to exist on both sides of the seam. The total residual contamination in this seam is:

$$(2 * 0.55\ m^2) * (811{,}520\ dpm/100\ cm^2) * (10{,}000\ cm^2/m\text{-}^2) * (\mu Ci/2.22E6\ dpm) = 40.2\ \mu Ci$$

Seam on East Wall

There was a strip of sealant near the center of the east wall of plenum 250 that was once the seal between the first stage filter racks and the wall. The average contamination level on this strip was 9,000,000 dpm/100cm^2 prior to decontamination. The strip and the concrete block it was attached to were removed and the area is now at background levels.

Hotspot in Stairwell

There is a small hotspot at the base of the remaining wall in the stairwell. The area is less than 1 foot square (.093m^2) and averages 5,000,000 dpm/100cm^2. This area was suspected of being representative of the stairs during the in-process survey, but decontamination of the area revealed the stairs were not significantly contaminated.
The total inventory of this hot spot is:

$$(0.093\ m^2) * 5{,}000{,}000\ dpm/100\ cm\text{-}^2) * (10{,}000\ cm^2/m\text{-}^2) * (\mu Ci/2.22E6\ dpm) = 20.9\ \mu Ci$$

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Ceiling

Filter Rack Remnants

The highest levels of contamination remaining on the ceiling are associated with pieces of the first stage filter racks that could not be removed. The remnants of filter rack on the west side were more contaminated than the remnants on the east side. Follow up surveys of the filter rack remnants on the east side found contamination levels on the filter racks were consistent with levels found during the PDS survey.

Seam between Filter Rack and West Wall

The seam between the west wall and the metal frame that once held the first stage filter racks is highly contaminated. The frame is welded to a support column and a small seam is filled with a durable sealant. Attempts to decontaminate this area were not successful. Heat guns, hand held shavers and scrapers were used to decontaminate this piece of metal. The most effective method was scraping. Scraping a one square foot area for one hour decreased contamination levels by less than 40%. Because the area is so difficult to decontaminate, it is not believed to present a significant risk of creating airborne during demolition. The seam is 18 feet (5.5 m) long, the contamination levels are assumed to penetrate the full depth of the seam, which is 4 inches (0.1m). The contamination level found on the surface is assumed to cover both sides of the seam. The average contamination levels found from eight readings taken along its length is 5,340,803 dpm/100cm^2. The total inventory of this seam is:

$$(2 * 0.55\ m^2) * (5,340,803\ dpm / 100\ cm^2) * (10,000\ cm^2/m^{-2}) * (\mu Ci / 2.22E6\ dpm) = 264.6\ \mu Ci$$

Remnants of West Side First Stage Filter Racks

This portion of rack will be painted blue because small areas exceed the SCO I level. Decontamination efforts on the first 60 feet (18.3 m) of this remnant were not successful because the elevated contamination is along the edges of welds and in small crevices created when angle iron was welded to the main body of the frame.

The majority of the frame is no more contaminated than the surrounding ceiling, but small hotspots which read up to 33,000,000 dpm frame an average contamination level of 3,432,000 dpm/100cm^2. Only one side of the frame is contaminated and it averages 6 inches (0.15m) wide. The total inventory remaining on this section of racks is:

$$(2.75\ m^2) * (3,432,000\ dpm/100\ cm^2) * (10,000\ cm^2/m^{-2}) * (\mu Ci / 2.22E6\ dpm) = 425.1\ \mu Ci$$

PDS Survey Results Summary

The values for the accessible areas and inaccessible areas were summed and divided by the total area for the survey unit to calculate the "Average Surface Contamination Value" ($ASCV_u$) and source term for the survey unit. The results are summarized in Table 2 below:

Table 2:
PDS Final Results

Area/ item	Final Results
776038 Source Term Columns (µCi)	1310.8
776038 Source Term Filter Racks (µCi)	425.1
776038 Source Term Inaccessible Areas (µCi)	2083.6
776038 Source Term Accessible Areas (µCi)	6674.6
776038 Total Source Term (µCi)	10,494
Survey Unit Area (m^2)	2149
$ASCV_u$ ($\mu Ci/m^2$)	4.88
$ASCV_u$ ($dpm/100cm^2$)	108,408

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Attachment 1

Calculating the ASCV

1. Sum the inventories from the inaccessible areas with the inventory for the accessible area to obtain a total inventory for the survey unit.

   Total Inventory = Accessible Inventory + Inaccessible inventory + Inventory items (areas not represented by other inventories listed i.e. Stairs, columns, etc)

   Example: 1000 μCi = accessible inventory

   122 μCi = inaccessible inventory

   100 μCi = inaccessible contamination in the columns and contamination on the stairs

   1000 + 122 + 100 = 1222 μCi

2. Divide the total inventory for the survey unit by the accessible area of the survey unit obtained from the final survey map.

   Example: 1222 μCi = total inventory

   1000 m2 = total surface area of the survey unit

   1222 μCi/1,000 m^2 = 1.22 μCi / m^2

   $\mathbf{1.22\ \mu Ci/m^2 * (1m^2/(100*100\ cm^2)) * (2.22E6\ dpm/\mu Ci) = 27084\ dpm/100cm^2}$

Total Surface Activity

Survey Area:		2nd Floor	Survey Unit:	776038			
Meter Model:		NE Electra w/ DP6 Probe				Date:	2/9/05
		1	2	3			
Instrument #:		4061	N/A	N/A	N/A	A priori MDA:	94
Cal. Due Date:		7/13/05	N/A	N/A	N/A	Avg. Local Bkgd	125.7
Efficiency (c/d):		0.222	N/A	N/A	N/A	Avg. Efficiency	0.222

Sample Location #	RCT ID #	Inst. #	Local Bkgd (cpm)	Gross (cpm)	(dpm/100 cm^2)
1	1	1	1.0	2.0	**4.5**
2	1	1	4.0	42.5	**173.4**
3	1	1	22.5	413.7	**1,762.2**
4	1	1	16.8	227.1	**947.3**
5	1	1	33.3	841.7	**3,641.4**
6	1	1	3.0	30.0	**121.6**
7	1	1	0.0	4.0	**18.0**
8	1	1	0.0	3.0	**13.5**
9	1	1	2.0	33.6	**142.3**
10	1	1	1.5	12.8	**50.9**
11	1	1	0.0	5.0	**22.5**
12	1	1	0.0	3.3	**14.9**
13	1	1	1.0	2.7	**7.7**
14	1	1	2.0	6.0	**18.0**
15	1	1	0.0	15.3	**68.9**
16	1	1	3.7	16.7	**58.6**
17	1	1	N/A	N/A	**N/A**
18	1	1	1.0	3.3	**10.4**
19	1	1	0.0	1.0	**4.5**
20	1	1	N/A	N/A	**N/A**
21	1	1	7.0	564.0	**2,509.0**
22	1	1	5.3	17.5	**55.0**
23	1	1	7.0	52.1	**203.2**
24	1	1	4.0	44.0	**180.2**
25	1	1	15.0	478.9	**2,089.6**
26	1	1	2.0	22.5	**92.3**
27	1	1	24.6	626.0	**2,709.0**
28	1	1	2.0	15.3	**59.9**
29	1	1	2.3	8.0	**25.7**
30	1	1	1.0	26.7	**115.8**
				MIN	**4.5**
				MAX	**3,641.4**
				MEAN	**540.0**
				SD	**1,005.2**

Removable Activity

Survey Area:		2nd Floor	Survey Unit:		776038
Dates Counted:	2/9/05				
A priori MDA:	16				
Efficiency (c/d)	0.333				
Smear Location Number	Smear Results				
	RCT ID #	Serial Number	Gross (cpm)	Bkg.	(dpm/100 cm^2)
1	1	1469	2.0	0.3	5.1
2	1	1469	9.0	0.3	26.1
3	1	1469	41.0	0.3	122.2
4	1	1469	27.0	0.3	80.2
5	1	1469	81.0	0.3	242.3
6	1	1469	11.0	0.3	32.1
7	1	1469	3.0	0.3	8.1
8	1	1469	1.0	0.3	2.1
9	1	1469	8.0	0.3	23.1
10	1	1469	4.0	0.3	11.1
11	1	1469	1.0	0.3	2.1
12	1	1469	0.0	0.3	-0.9
13	1	1469	0.0	0.3	-0.9
14	1	1469	1.0	0.3	2.1
15	1	1469	3.0	0.3	8.1
16	1	1469	7.0	0.3	20.1
17	1	1469	N/A	N/A	N/A
18	1	1469	1.0	0.3	2.1
19	1	1469	0.0	0.3	-0.9
20	1	1469	N/A	N/A	N/A
21	1	1469	56.0	0.3	167.3
22	1	1469	8.0	0.3	23.1
23	1	1469	22.0	0.3	65.2
24	1	1469	7.0	0.3	20.1
25	1	1469	48.0	0.3	143.2
26	1	1469	6.0	0.3	17.1
27	1	1469	68.0	0.3	203.3
28	1	1469	1.0	0.3	2.1
29	1	1469	2.0	0.3	5.1
30	1	1469	15.0	0.3	44.1
				MIN	-0.9
				MAX	**242.3**
				MEAN	**45.5**
				SD	67.3

Sodium Iodide Instrument Information

Survey Area:	2nd Floor	Survey Unit:	776038	Survey Date(s):	02/01/05

Instrument Specifications

Instrument #	1	2
Meter Model:	Ludlum 2350-1	Ludlum 2350-1
Meter Serial #:	203449	N/A
Detector Model:	Ludlum 44-17	Bicron G-5
Detector #:	199757	N/A
Detector Size (cm^2):	17.8	125
Calibration Due Date:	5/2/05	N/A
Count Time (min)	5	5
Contact Efficiency	8.30%	N/A

Ratio Used

Pu to Am - 241	8.1

Comments

In cases where the critical level is greater than the calculated dpm/100cm2, the critical level will be used for statistical analysis.

Count Times for backgrounds and samples are equal.

Attenuation Factors: Based on observation of Walls and Ceilings. Epoxy on Floor determined by chip sampling.

Background (Gross)

Instrument #	1	2
Gamma (Ceilings)	573	N/A
Gamma (Floors)	N/A	N/A
Gamma (Walls)	556	N/A
	N/A	N/A

Background (cpm)

Instrument #	1	2
Gamma (Ceilings)	114.6	N/A
Gamma (Floors)	N/A	N/A
Gamma (Walls)	111.2	N/A

Efficiencies (cpm/dpm)

Instrument #	1	2
Thin/No Paint	0.082	#VALUE!
Epoxy	0.067	#VALUE!
Other	0.054	#VALUE!

Coatings

	Thickness (inches)
Thin/No Paint	0.015
Epoxy	0.250
Other	0.5

Sodium Iodide Instrument Information

Survey Area:	2nd Floor	Survey Unit:	776038	Survey Date(s):	02/04/05

Instrument Specifications

Instrument #	1	2
Meter Model:	Ludlum 2350-1	Ludlum 2350-1
Meter Serial #:	203449	203449
Detector Model:	Ludlum 44-17	Ludlum 44-17
Detector #:	199757	199764
Detector Size (cm^2):	17.8	17.8
Calibration Due Date:	5/2/05	6/9/05
Count Time (min)	5	5
Contact Efficiency	8.30%	9.20%

Ratio Used

Pu to Am - 241	8.1

Comments

In cases where the critical level is greater than the calculated dpm/100cm2, the critical level will be used for statistical analysis.

Count Times for backgrounds and samples are equal.

Attenuation Factors: Based on observation of Walls and Ceilings. Epoxy on Floor determined by chip sampling.

Background (Gross)

Instrument #	1	2
Gamma (Ceilings)	N/A	N/A
Gamma (Floors)	N/A	N/A
Gamma (Walls)	436	741
	N/A	N/A

Background (cpm)

Instrument #	1	2
Gamma (Ceilings)	N/A	N/A
Gamma (Floors)	N/A	N/A
Gamma (Walls)	87.2	148.2

Efficiencies (cpm/dpm)

Instrument #	1	2
Thin/No Paint	0.082	0.091
Epoxy	0.067	0.074
Other	0.054	0.060

Coatings

	Thickness (inches)
Thin/No Paint	0.015
Epoxy	0.250
Other	0.5

Sodium Iodide Instrument Information

Survey Area:	2nd floor	Survey Unit:	776038	Survey Date(s):	02/09/05

Instrument Specifications

Instrument #	1	2
Meter Model:	Ludlum 2350-1	Ludlum 2350-1
Meter Serial #:	201199	203457
Detector Model:	Ludlum 44-17	Bicron G-5
Detector #:	199764	B940T
Detector Size (cm^2):	17.8	125
Calibration Due Date:	6/9/05	6/8/05
Count Time (min)	5	5
Contact Efficiency	8.80%	5.60%

Ratio Used

Pu to Am - 241	8.1

Comments

In cases where the critical level is greater than the calculated dpm/100cm2, the critical level will be used for statistical analysis.

Count Times for backgrounds and samples are equal.

Attenuation Factors: Based on observation of Walls and Ceilings. Epoxy on Floor determined by chip sampling.

Background (Gross)

Instrument #	1	2
Gamma (Ceilings)	326	N/A
Gamma (Floors)	N/A	9473
Gamma (Walls)	734	N/A
	N/A	N/A

Background (cpm)

Instrument #	1	2
Gamma (Ceilings)	65.2	N/A
Gamma (Floors)	N/A	1894.6
Gamma (Walls)	146.8	N/A

Efficiencies (cpm/dpm)

Instrument #	1	2
Thin/No Paint	0.087	0.055
Epoxy	0.071	0.045
Other	0.057	0.036

Coatings	Thickness (inches)
Thin/No Paint	0.015
Epoxy	0.250
Other	0.5

NaI Activity Measurements

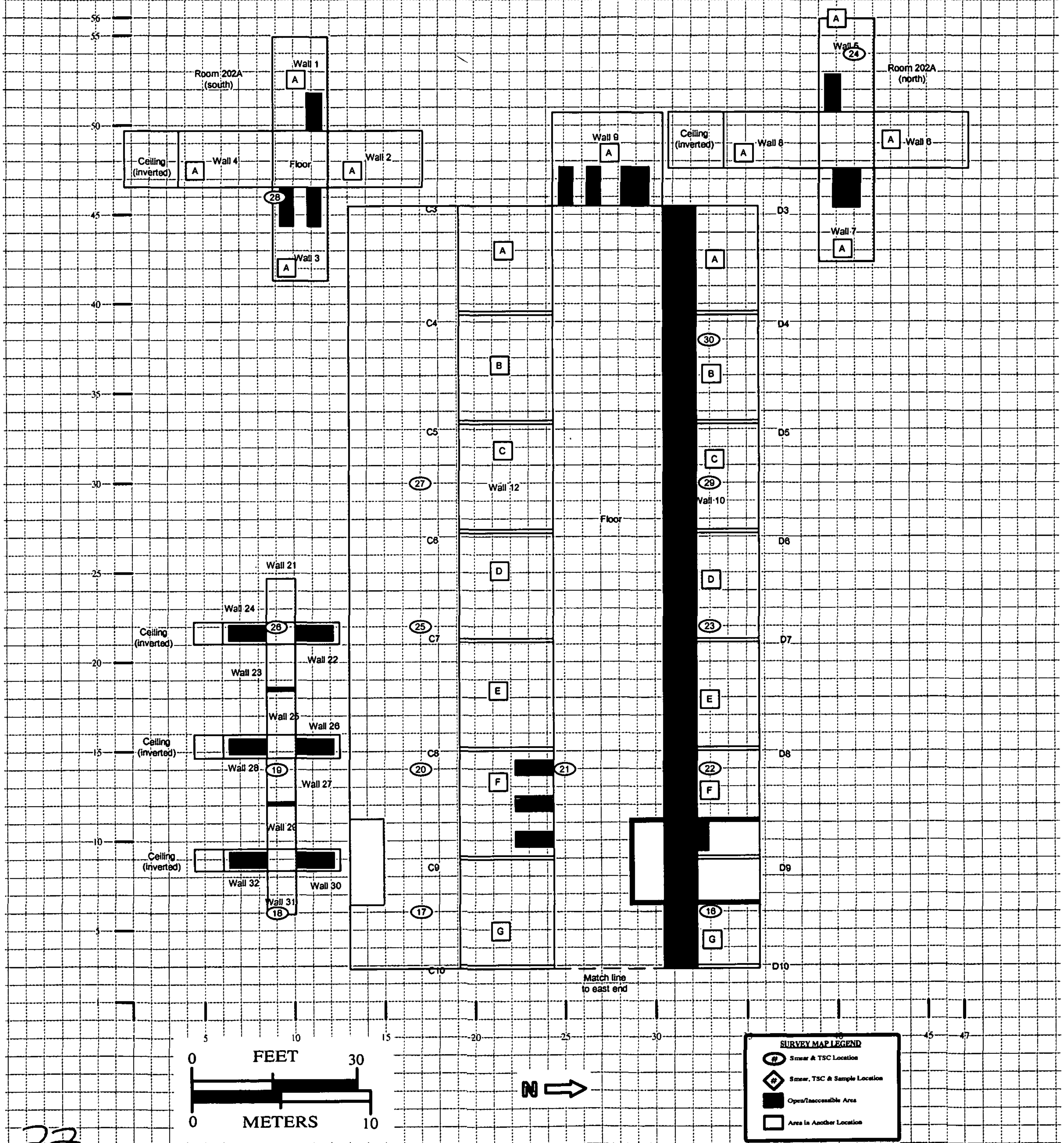
Sample Number	Instrument Used	Comment	Surface	Coating	(dpm/100 cm^2)
1	NaI	N/A	Wall	Thin/No Paint	26,924
2	NaI	N/A	Floor	Thin/No Paint	28,272
3	NaI	N/A	Wall	Thin/No Paint	124,734
4	NaI	N/A	Wall	Thin/No Paint	126,844
5	NaI	N/A	Wall	Thin/No Paint	44,762
6	NaI	N/A	Floor	Thin/No Paint	5,308
7	NaI	N/A	Wall	Thin/No Paint	25,352
8	NaI	N/A	Wall	Thin/No Paint	24,828
9	NaI	N/A	Floor	Thin/No Paint	5,308
10	NaI	N/A	Wall	Thin/No Paint	65,375
11	NaI	N/A	Wall	Thin/No Paint	10,996
12	NaI	N/A	Wall	Thin/No Paint	27,879
13	NaI	N/A	Wall	Thin/No Paint	6,093
14	NaI	N/A	Floor	Thin/No Paint	51,105
15	NaI	N/A	Ceiling	Thin/No Paint	22,881
16	NaI	N/A	Wall	Thin/No Paint	423,025
17	NaI	N/A	Ceiling	Thin/No Paint	4,400
18	NaI	N/A	Wall	Thin/No Paint	38,552
19	NaI	N/A	Wall	Thin/No Paint	47,666
20	NaI	N/A	Ceiling	Thin/No Paint	7,438
21	NaI	N/A	Floor	Thin/No Paint	160,042
22	NaI	N/A	Wall	Thin/No Paint	284,426
23	NaI	N/A	Wall	Thin/No Paint	114,818
24	NaI	N/A	Floor	Thin/No Paint	6,093
25	NaI	N/A	Ceiling	Thin/No Paint	4,400
26	NaI	N/A	Floor	Thin/No Paint	14,558
27	NaI	N/A	Ceiling	Thin/No Paint	7,124
28	NaI	N/A	Floor	Thin/No Paint	23,547
29	NaI	N/A	Wall	Thin/No Paint	159,656
30	NaI	N/A	Wall	Thin/No Paint	165,313
				MIN	**4,400**
				MAX	**423,025**
				AVERAGE	**68,591**
				SD	**94,662**

RADIOLOGICAL CLOSEOUT SURVEY FOR THE 776 CLUSTER

Survey Area: 2nd Floor | **Survey Unit: 776038** | **Classification: NA**
Building: 776
Survey Unit Description: Plenum 250

Total Floor Area: 498 sq. m | **Total Area: 2149 sq. m** | **Random Start Grid Size: 8 x 8 sq. m**

SURVEY UNIT 776038 - MAP 1 OF 2

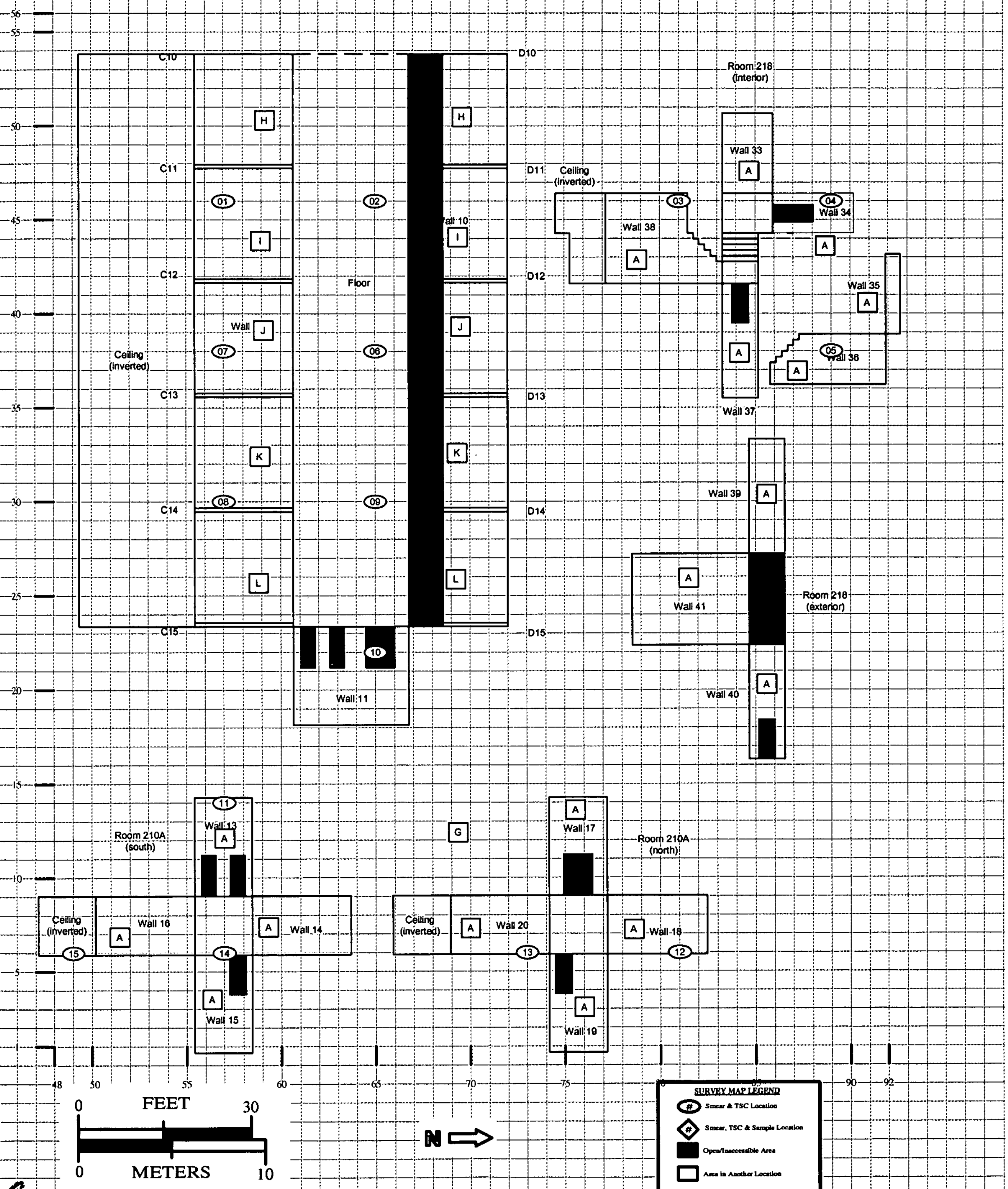


RADIOLOGICAL CLOSEOUT SURVEY FOR THE 776 CLUSTER

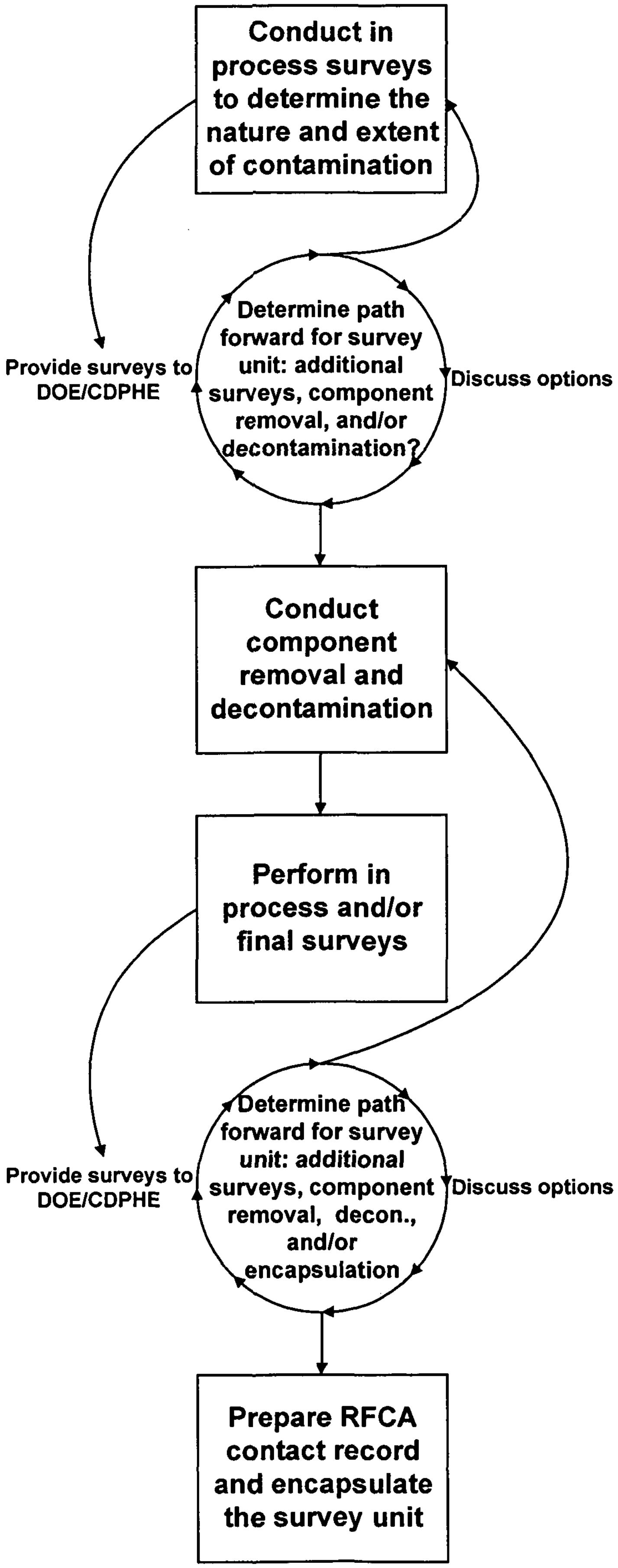
Survey Area: 2nd Floor | Survey Unit: 776038 | Classification: NA
Building: 776
Survey Unit Description: Plenum 250

Total Floor Area: 498 sq. m | Total Area: 2149 sq. m | Random Start Grid Size: 8 x 8 sq. m

SURVEY UNIT 776038 - MAP 2 OF 2



23/24


Conduct in process surveys to determine the nature and extent of contamination
Provide surveys to DOE/CDPHE
Determine path forward for survey unit: additional surveys, component removal, and/or decontamination?
Discuss options
Conduct component removal and decontamination
Perform in process and/or final surveys
Provide surveys to DOE/CDPHE
Determine path forward for survey unit: additional surveys, component removal, decon., and/or encapsulation
Discuss options
Prepare RFCA contact record and encapsulate the survey unit